

Gudu-kut Natural Area

(City View Wetland)

Management Plan



June 2002



Gudu-kut

As part of this planning process, the citizen steering committee has made the recommendation that the site be renamed the *Gudu-kut Natural Area*. Gudu-kut is the Kalapuyan name for frog. The Pacific tree frog was once common on the site, but have declined in recent years. It is hoped that through implementation of this management plan, the tree frog population, along with other native wildlife species will increase.

Gudu-kut Natural Area

(City View Wetland)

Management Plan

Prepared for



City of Eugene • Parks and Open Space Division •

Wetlands and Open Waterways Section

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June 2002

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Background

Site Description

The 6.4-acre Gudu-kut Natural Area (site), formerly known as the City View Wetland, is located in southwest Eugene, immediately adjacent to Amazon Creek and just to the east of the intersection of West 14th Avenue and City View Street. Multi-family residential development lies immediately to the north and south. The site is currently in City of Eugene ownership, purchased in November 2000 for the purpose of wetland preservation and enhancement. The site lies within the West Eugene Wetlands Plan (WEWP) boundary and contains approximately 3.3 acres of jurisdictional wetlands (Judith Henschel, 1997). Under the WEWP, the site is designated for protection.



*Gudu-kut Natural Area,
January 2002*

Land uses within the proximity of the site are predominately single- and multi-family residential, with some commercial uses along 11th Avenue to the north and 18th Avenue to the south. Westmoreland Elementary School lies approximately 1/4 mile to the south. The site is a unique remnant of open space in an otherwise largely developed neighborhood.

Regional Context

Located near the southern end of the Willamette Valley, the city of Eugene is Oregon's second largest city with an estimated 2001 population of 140,550. It lies in the Eugene-Springfield metropolitan region with an urban growth boundary population of approximately 222,400. The metropolitan region lies at the confluence of three of Oregon's major physiographic regions: the Western Cascades, the Coast Range, and the Willamette Valley.







The Coast and Middle Forks of the Willamette River converge at the southern edge of the metropolitan region and the main-stem of the Willamette River flows through Eugene, and the McKenzie River joins the Willamette River on the northern edge of the metropolitan region. Amazon Creek, the third largest waterway in the metropolitan region, originates in the south hills of Eugene and flows northward and westward to enter the Long Tom River system at Fern Ridge Reservoir. Amazon Creek ties together a number of significant public open spaces as it flows through

Gudu-kut Natural Area

Regional Context Map

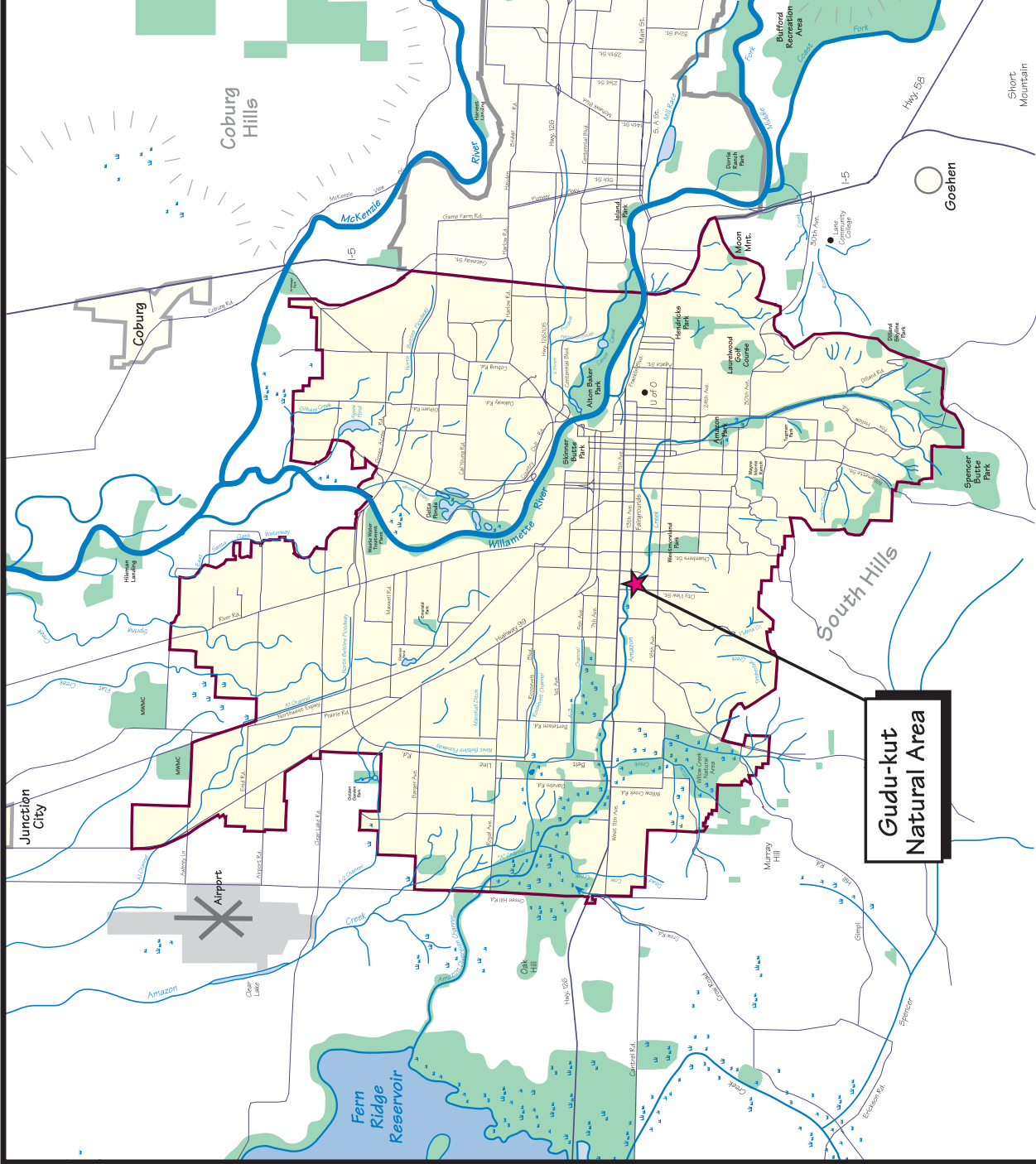
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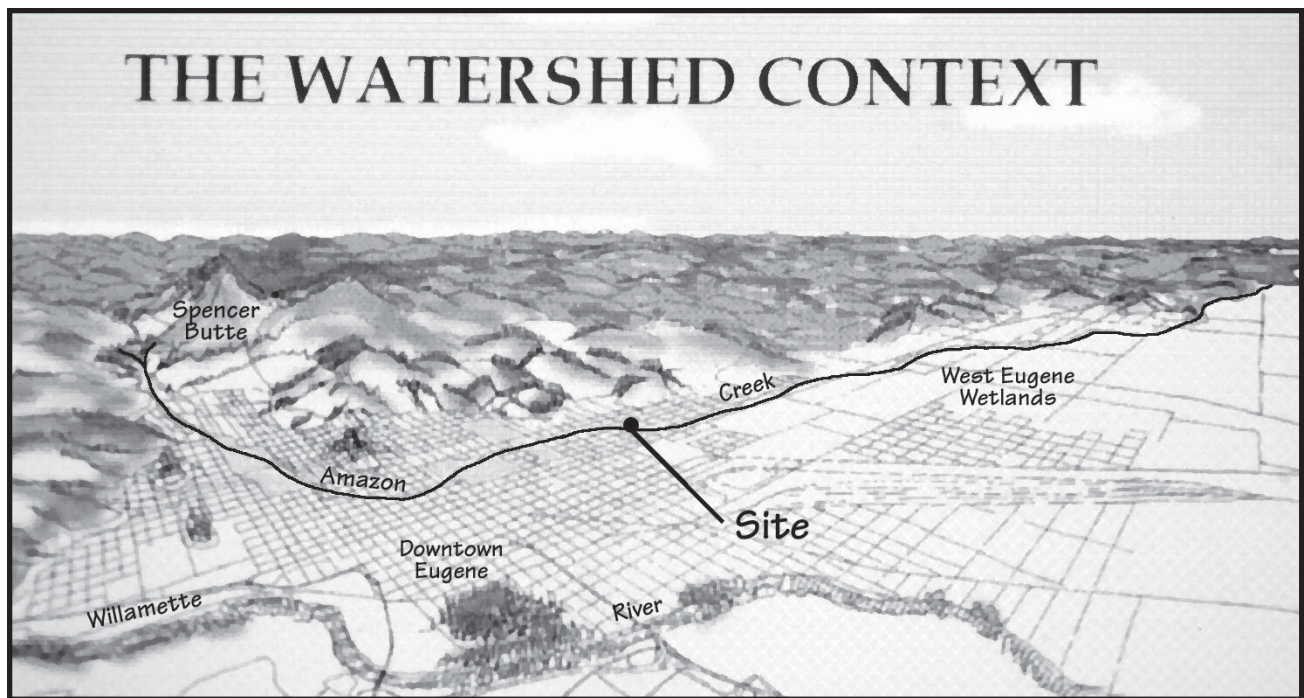
Legend

-  Gudu-kut Natural Area
-  Major Public Parks and Open Spaces
-  Major Rivers and Waterways
-  Significant Wetland Area
-  Eugene Urban Growth Boundary
-  Other Urban Growth Boundaries



Map produced for the City
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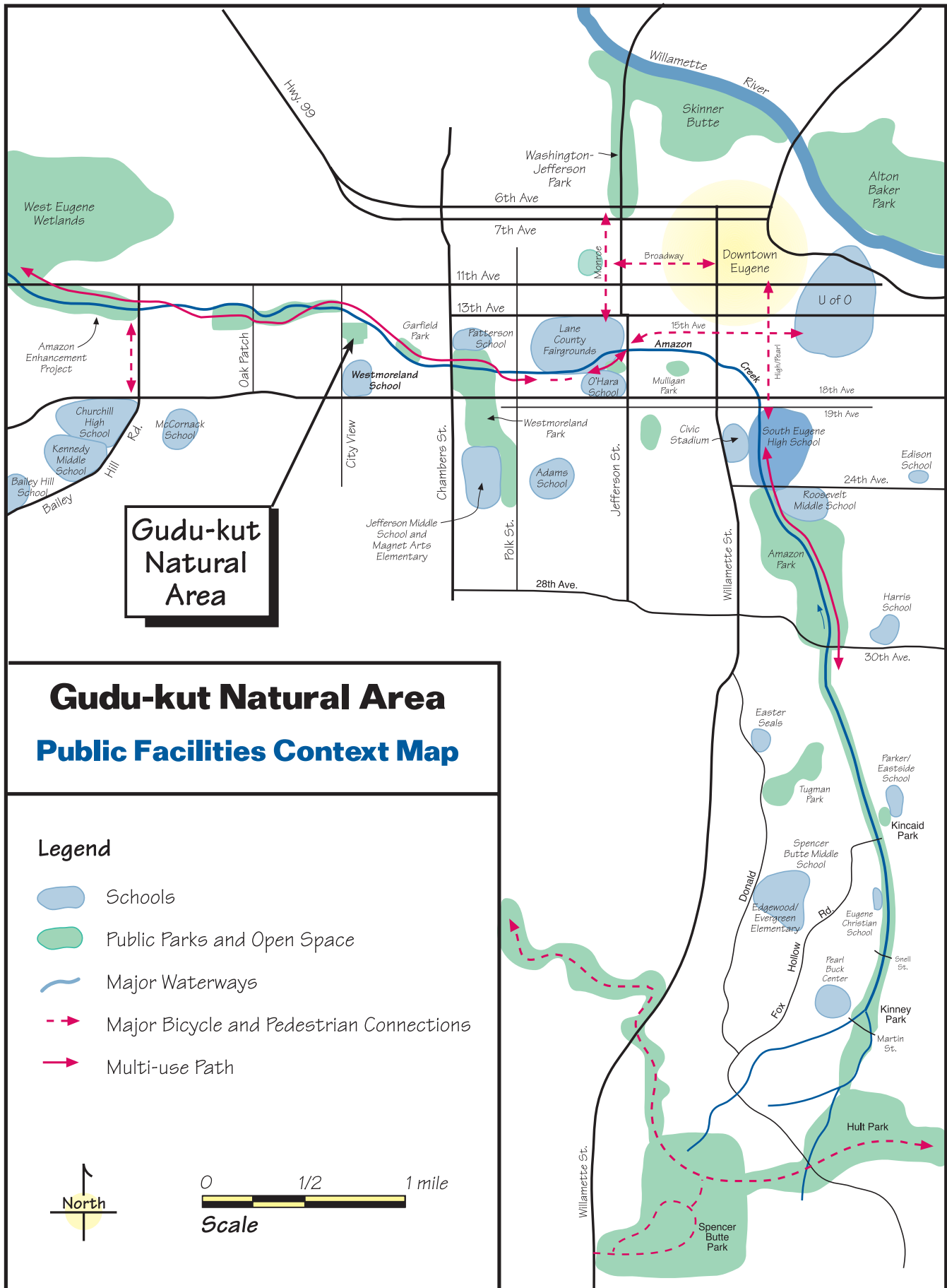




Eugene including Spencer Butte Park, Amazon Park, the Lane County Fairgrounds, Westmoreland Park, the west Eugene wetlands, and now the Gudu-kut Natural Area. The City sees the Gudu-kut Natural Area as a component of a larger strategy to enhance the entire length of Amazon Creek from its headwaters to Fern Ridge Reservoir through its comprehensive land use, parks, and stormwater planning programs.

When viewed in sum, the City's comprehensive land use, parks, and stormwater planning programs direct protection and restoration of the Amazon Creek corridor to meet multiple objectives, including wildlife habitat, water quality, flood management, storm conveyance, scenic assets, recreation and open space corridors, and education. The goals and policies call for:

- The protection of the Amazon Creek corridor (for open space and recreational values);
- Enhancement of vegetation (for habitat, scenic, and water quality purposes);
- Preservation and enhancement of habitat (for animals and plants, especially those of endangered or threatened species);
- Preservation of flood capacity (to reduce danger to life and property);
- Water quality protection (to use waterways with vegetated riparian zones as filtering devices for urban runoff and bank stabilization); and
- Providing outdoor educational resources (for schools and the community at large).

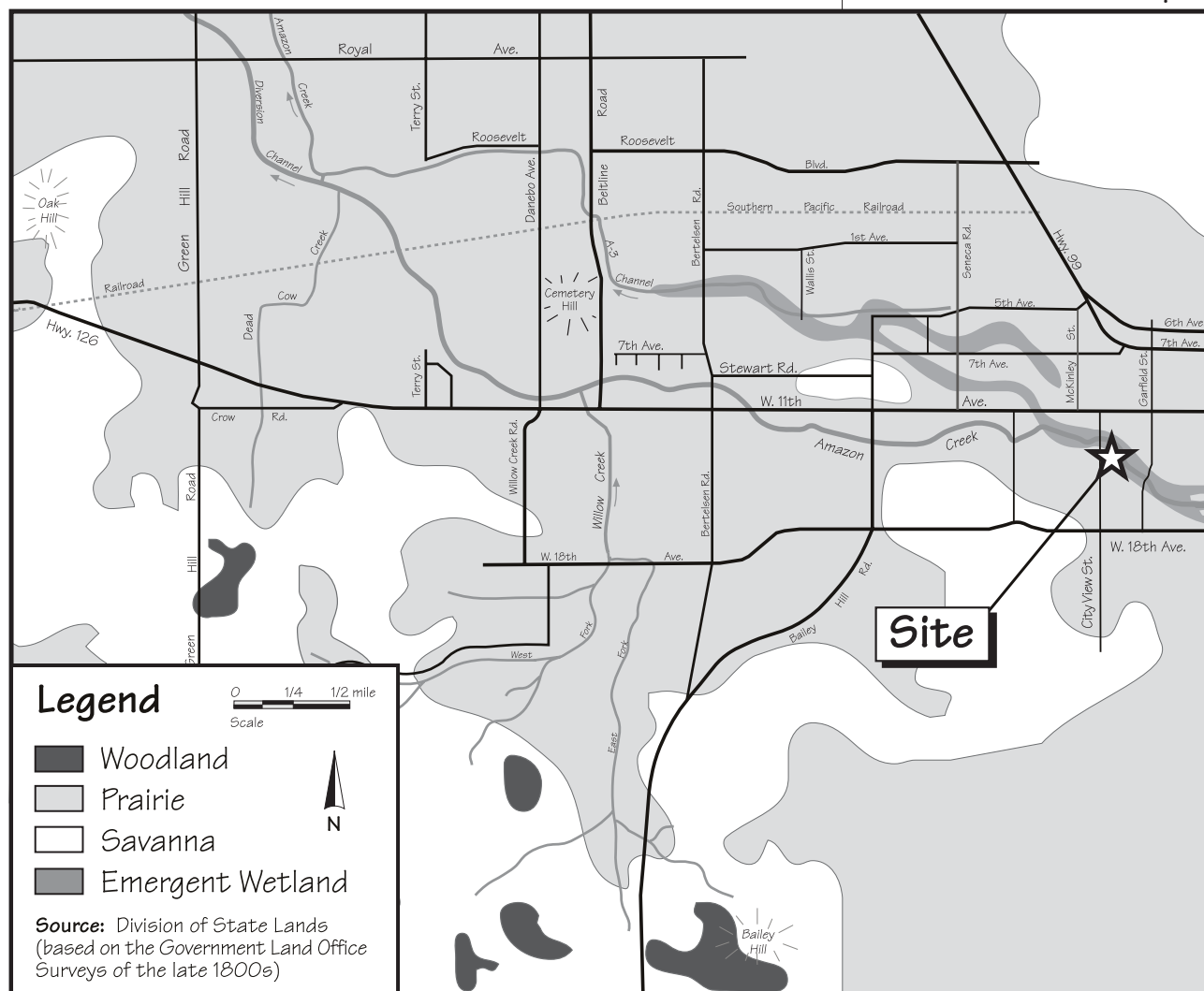


Site History

Historic Conditions

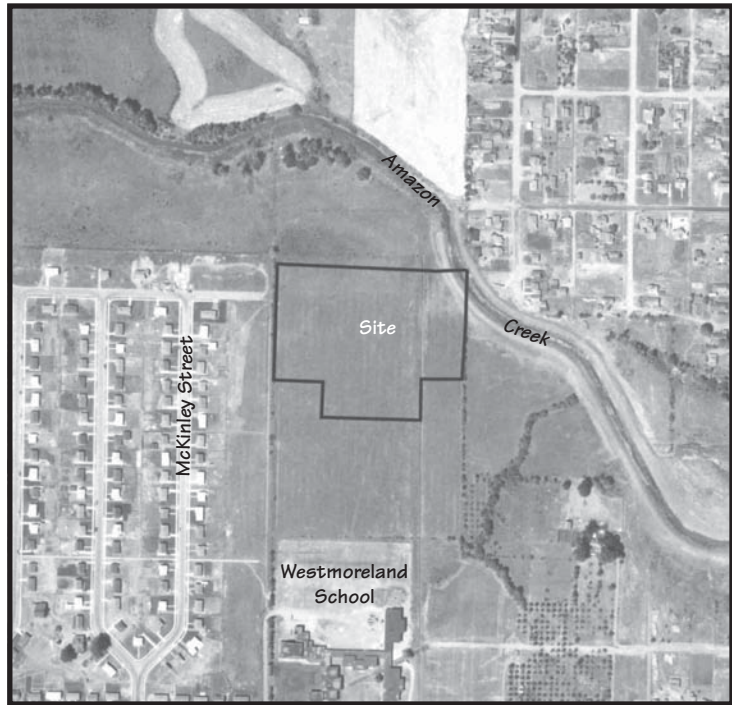
Based on Government Land Office surveys of the 1850s, the site was historically dominated by wetland prairie and emergent wetland and was likely flooded seasonally by nearby Amazon Creek (see Historic Vegetation Map). The 1997 wetland delineation (Henshel, 1997) included some documentation using aerial photography which showed that the site has been vacant since at least 1936, with some cultivation evident from the aerial photographs taken in 1936, 1946, and 1952. The 1936 aerial photograph shows that much of the area was wet when it was farmed. The water apparently moved north and west, and flowed back into Amazon Creek via a small tributary one-quarter mile west of the property. In the 1950s, Amazon Creek was straightened and deepened by the U.S. Army Corps of Engineers (Corps) to improve floodwater conveyance in the

Historic Vegetation Map





1936 Aerial Photo



1952
Aerial
Photo

rapidly urbanizing area. This modification severed any natural hydrologic connectivity between the wetlands on the site and the Creek. The site has not been cultivated since at least 1974 when the surrounding lands became developed with townhouses and apartments to the north, east, and south. This is confirmed by the fact that numerous large trees are now present on the site.

How Site Came into Public Ownership

In fall 1998, Bingham Construction, Inc. submitted an application requesting authorization from the Army Corps of Engineers (Corps) and the Oregon Division of State Lands (DSL) to place fill in wetlands in preparation for development plans to construct a 130-unit multi-family development, including parking and a community building. At the time of the development proposal, the property had been owned by the applicant's family (City View Investment Inc.) for approximately 30 years.

In the fall of 1999, area neighbors observed that trenches had been dug in the site's wetlands and subsequently alerted both Eugene city officials and the Corps. Upon City inspection of the site, it was revealed that the required erosion permits had not been obtained. Earlier that summer, drain-pipe cleaning activity on the site had been halted when it was learned that the required Corps permits had not been obtained.

In winter 1999, the Westmoreland Wetland Advocacy Group (WWAG) voiced its opposition to the development plan. WWAG, a non-profit, unincorporated public interest group, is dedicated to protecting the Gudu-kut Natural Area as well as other wetlands in the WEWP area. At that time, WWAG had over 25 active members and enrolled the support of at least 37 households in the area.



The site pictured during winter conditions (January 2002) with the Leawood Townhomes in the background.

In November 2000, the City acquired the site based on its wetland, stormwater, and habitat values. The WWAG provided ongoing support including obtaining the support of Senator Ron Wyden and Congressman Peter DeFazio. This acquisition was funded through a combination of City stormwater and wetlands funds. The City is currently undergoing a process of developing a long-term management plan for the site, working with representatives of the WWAG and other interested parties. The WWAG will likely continue its involvement with the site as an adoption group through the City of Eugene's stormwater program.

Adjacent land uses consist primarily of multi-family housing. A fence was recently constructed by the City between the West Hill Village Apartments (right) and the site.

Existing Conditions

The site currently contains approximately 3.3 acres of forested and prairie wetland (see Existing Conditions Map). Much of the site's perimeter is now upland, likely the result of fill material being spread onto the site, probably related to the Amazon Creek channelization project and adjacent development activities several decades ago.

The site's ponded areas are likely the result of irregular





Several ephemeral (seasonal) ponds exist on the site.

Amazon Creek flows by the eastern edge of the site.

Little hydrological connection currently exists between the creek and the on-site wetlands.



placement of fill material as suggested by their erratic configuration and the site's readily apparent sudden topography changes. Alterations resulting from years of agricultural cultivation and mowing have displaced much of the site's historic prairie plant communities. Mowing and drainage practices

have likely resulted in long-term compaction to the soils in both the upland and wetland areas (Guard).

Surface Hydrology

Water on-site primarily originates from rainfall, with some runoff probably entering the site from the neighboring apartment complexes to the south. Ponding and near-surface saturation occurs across the center of the site, which form several ephemeral ponds up to 18 inches in depth during the winter (see Existing Hydrology Map). Surface water generally sheet flows across the site from south to north and into the ponded areas. As the ponds overflow

during periods of heavy precipitation, water flows toward Amazon Creek to the east through two narrow trenches that were illegally cut in the late 1990s in a failed attempt to drain the ponds. The trenches seem to have minimal effect at lowering the water level of the ponds and could easily be blocked. Runoff from the western edge of

the site flows toward City View Street and crosses under the sidewalk through a six-inch PVC drainpipe and over the sidewalk in two areas during heavy rainfall.

Water, perched on the heavy clay soils, remains on the site well into the growing season, eventually drying out through evaporation and slow percolation by early summer.

Amazon Creek flows past the eastern edge of the site in a channel approximately seven feet deep, with steep 1:1 slopes. The 100 year flood plain does not extend onto the site and the wetlands have little hydrologic relationship to the creek. Bank failure, or slumping, is currently occurring along the portion of the channel that lies immediately adjacent to the site due to the steepness of slope (see Existing Conditions Map).

Geomorphology and Soils

The Gudu-kut Natural Area site is located on the Calapooyia geomorphic surface and the soils are part of the wide swath of nearly level Natroy soil that is common along much of Amazon Creek. Characteristics of the Calapooyia geomorphic surface are low relief (less than a 0.2 percent average gradient), very poorly defined drainage pattern, slow drainage of surface water, and hummocky microtopography.

Natroy is a deep and poorly drained soil type which, typically consists of a 5-inch layer of silty clay loam over several feet of dark gray clay. Permeability of Natroy soil is very slow and is classified as a hydric, or wetland, soil type by the Natural Resource Conservation Service. The on-site fill material present on portions of the site is irregular in thickness and varies throughout the site, but Natroy was apparent under the fill at most sample points (Scoles Associates).



Wetland soils on-site support a mix of native and non-native wetland species. Fill has been spread on other portions of the site, resulting in an upland plant community dominated primarily by non-native grasses.

Vegetation

Based on Government Land Office surveys of the 1850s and the Soil Survey of Lane County (1987), the site was likely historically dominated by a wetland prairie and emergent wetland plant community, with potentially some riparian or forested wetland species present adjacent to Amazon Creek. Past agricultural use, mowing, and filling have significantly degraded the native wetland prairie plant community on the site, although some pockets with good native composition do exist. A number of large Oregon ash (*Fraxinus latifolia*) are present on the site along with smaller quantities of black cottonwood (*Populus trichocarpa*), Hawthorn (*Crataegus* sp.), and several large cultivated weeping willow (*Salix babylonica*).

Phil Scoles (Scoles Associates) documented four general plant communities on the site during a pre-development site review conducted in the late 1990s. These include:

- 1. Disturbed Tall Fescue Field**, a weedy plant community that dominates the majority of the site, consisting of Tall fescue, hedgehog dogtail, Queen Anne's lace, English plantain, common orchardgrass, reed canary-grass, with traces of bentgrass, teasel, and chicory.
- 2. Disturbed Tufted Hairgrass/Bentgrass Field**, composing the only resemblance to wet prairie, contains tufted hairgrass, bentgrass, tall fescue, soft rush, and slender rush. Subdominates include beggars-tick, gumweed, self-heal, buttercup, catsar, and English plantain.
- 3. Seasonally Ponded Emergent Bottomland** is composed of scattered Oregon ash, bentgrass, soft rush, spreading rush, various sedges, western mannagrass, and pennyroyal. It typically has seasonal open water during the winter and spring.
- 4. Oregon Ash Bottomland** consists of Oregon ash, wild rose, tall fescue, bentgrass, tufted hairgrass, spreading rush, and various sedges. The ash trees are relatively large, suggesting a lack of disturbance in this areas for the past 20 years.

The site is not known to support any rare, endangered, or threatened plant or animal species.

The wetland delineation conducted by Judith Henschel in 1997 documented four general plant communities within the site, but did not specifically map their location. These include:

1. The **wetland** included pennyroyal (*Mentha pulegium*), colonial bentgrass (*Agrostis tenuis*), Kentucky fescue (*Festuca arundinacea*), gumweed (*Grindelia integrifolia*), and slender rush (*Juncus tenuis*).
2. The recently mowed **upland** areas included Kentucky fescue (*Festuca arundinacea*), spotted cat's ear (*Hypochaeris radicata*), heal all (*Prunella vulgaris*), white clover (*Trifolium repens*), oxeye daisy (*Leucanthemum vulgare*), and parentucellia (*Parentucellia visosa*).
3. The **mosaic of 50 percent wetland and 50 percent upland** included some gumweed (*Grindelia integrifolia*), sporadic patches of pennyroyal (*Mentha pulegium*), colonial bentgrass (*Agrostis tenuis*) in spots, with no oxeye daisy (*Leucanthemum vulgare*).
4. A **human-influenced wetland pocket** just north of the pond was dominated by small-fruited bulrush (*Scirpus microcarpus*).

A community of meadow barley exists around the ponded and marsh areas along the northern fence line at approximately the mid-section of the site. Meadow barley communities are being tracked by the Oregon Natural Heritage Program (ONHP). In addition to meadow barley, tufted hairgrass, and another somewhat unusual species, Harding grass were found in this area. However, Harding grass, is an introduced wetland species and is not considered as an enhancement to the general plant association (Guard).

Non-native Invasive Plant Species

The Gudu-kut Natural Area contains a mix of native and exotic plant species. Although the site is largely free from some of the more common invasive exotic species such as Scot's broom (*Cytisus scoparius*) and has only small pockets of Himalayan blackberry (*Rubus armeniacus*), others are present in abundance.

In particular, the upland and wetland prairie areas contain considerable non-native plant composition, although this is mixed in most areas with some native grasses and forbs. The most problematic and invasive species present are colonial bentgrass (*Agrostis tenuis*), Harding grass (*Phalaris aquatica*), tall fescue (*Festuca arundinacea*), and pennyroyal (*Mentha pulegium*), all of which are very difficult to eradicate or control. Another highly invasive species in our region, Reed canary-grass (*Phalaris arundinacea*), is present, but not currently abundant on the site and will likely spread

throughout the site if not controlled in the near future. Its presence should be monitored closely since it thrives in ephemeral ponds, common to the site. A small cluster of weeping willow (*Salix babylonica*) and some scattered Washington hawthorn (*Crataegus monogyna*) are the only non-native tree species currently present and their spread is easily controlled through mowing.

Utilities

A 36 inch sanitary sewer line runs under the site from west to east and a smaller private trunk line runs from the West Village Apartments, meeting this main line near the middle of the site. This private line is failing and will require replacement in the near future. In addition, a 48 inch stormwater line runs along the sites eastern edge prior to entering Amazon Creek. No other utilities are known to exist on the site, but a full utility locate should be done prior to any earth disturbing activities.

Planning Process

In January 2002, Lane Council of Governments (LCOG) began facilitating the development of this management plan under contract with the City of Eugene (City). In addition to working with City staff representatives from the Parks and Open Space Division, a group of nine citizen stakeholders provided input and direction throughout the process. The stakeholders included representatives from the Westmoreland Wetland Advocacy Group, neighbors, and a teacher from Westmoreland School. The stakeholders provided valuable input and care deeply about the site. These people will likely make up the core of any future adoption group that will help the City implement the proposed strategies and manage and care for this site in the years to come.



Steering committee members and staff from left: Trevor Taylor (City), Jeff Krueger (LCOG), Chris Tupper, John Newsom (Westmoreland School), Doug Quirk, Ginger Gietzen, John Henry, Ona Cunningham, Edith White, Paul Cunningham, Anita Robinson, Megan Banks (LCOG). Not pictured: Lorna Baldwin (City).

A total of three meetings and a field trip were held with the stakeholders group and City staff during the development of this Plan. The focus of these meetings was as follows:

- **Wetland Field Trip:** Committee members met LCOG and City staff at the Balboa wetland mitigation site in west Eugene to look at this recent wetland restoration, trails, and existing high-quality wetlands in the area. In addition, the group looked at the Amazon Creek Enhancement Project and discussed the concept of channel widening and its applicability to the City View site.
- **Meeting One:** The first official meeting focused on reviewing the site assessment report, defining issues and opportunities, and formulating management goals. The management goals were then refined by staff and reviewed by committee members at the beginning of the second meeting.

- **Meeting Two:** The second meeting was held on the Gudu-kut Natural Area site and focused on devising a set of management options (using the goals as a guide). At this meeting, the group was split into two smaller working groups, which discussed options and ideas as they walked the site. At the end of the meeting, each group presented their ideas to the larger group. In general, both groups shared a number of similar ideas and these were used as a starting point for staff as they developed a draft set of strategies.
- **Meeting Three:** At the third meeting, the draft management strategies were presented and discussed. The end of this meeting resulted in the refinement of the strategies and general consensus by the group on the proposed approaches. A fourth meeting is planned for summer 2002 and will focus on the implementation of this Plan, specifically setting up a work program for the anticipated Stream Team adoption group and prioritizing actions.

Ideas, Issues, and Opportunities

The following list of ideas, issues, and opportunities was recorded during the April 2, 2002, steering committee meeting. Many of these comments were recorded verbatim or are a summary of discussion.

- Meeting all of the goals and policies listed on page 3 of the background report may not be possible. We may want to focus on just a few of these like:
 - Wildlife habitat (tree frogs, migratory birds),
 - Ponds, and
 - Plants.
- The site may be too small to accommodate recreational uses
- Focus on educational opportunities geared toward protecting the site.
- There is potential for restoration on the site (mini ecosystem).
- Focus on education
- Allow access for educational purposes (otherwise the site is of little value to kids).
- Eastern Gateway restored wetland is a good example of limited site access.
- Miracle on 33rd Street adoption group has done a nice job of riparian planting.
- A raised boardwalk (ADA compliant) may be a good idea.
- Minimize impacts to the site (limit access to upland only).

- Must balance access and habitat
- Provide access to the creek for educational purposes?
- Need to keep the site safe for children
- Use of the site by campers is problematic.
- Could improve bird habitat (birds are less common since the understory plants were cut out and the pond size reduced).
- Site is valuable as a *wild area* in an otherwise urban landscape.
- Creating good habitat and reducing the site's desirability for campers may be at odds.
- Students can help with planting and restoration.
- Should limit site access to just a few areas (not entire site).
- Kids need places where they can have unstructured outdoor exploration.
- Wildlife habitat and the native plant community should be improved.
- The wetlands are a nice thing to view from the adjacent neighborhood.
- Dog use on the park should be discouraged.
- Watering options: new plantings could be watered using a barrel (drip) system.
- Funding constraints may limit what can be done on the site.
- The City's mitigation bank may be a good option for funding some of the restoration and enhancement work.
- Trails can be used to direct access (reducing it in more sensitive areas)
- Ability of the City to maintain the site should be considered
- Look at ways to limit access to the site (fencing?).
- The site is owned by all the citizens of Eugene.
- Creating a safe place should be a high priority.

The following goals were developed based on stakeholder and staff input following the first stakeholder meeting and then reviewed at the second meeting. These goals have been used to generate the Action Plan and implementation strategies presented later in this document.

Goal 1: Wildlife Habitat

Enhance conditions for native wildlife species associated with wet prairie, forested wetland, and emergent wetland habitat.

Goal 2: Vegetation

Protect, restore, and enhance native wetland and upland plant communities throughout the site.

Goal 3: Recreation

Limit on-site recreation to passive uses such as nature study, bird watching, and walking.

Goal 4: Education

Provide an educational resource or outdoor classroom for area schools and neighbors.

Goal 5: Access

Provide access to the site for passive recreation and educational uses, but limit the extent of a formalized trail system.

Goal 6: Safety

Provide a safe and secure environment for students and neighbors using the site and discourage illegal activities on the site such as camping.

Goal 7: Maintenance

Minimize site maintenance requirements and work with volunteers to help care for site over time.

Goal 8: Visual Quality

Enhance the visual quality of the site and reduce the visual impact of adjacent development on views from the site.

Proposed Actions

Range of Habitat Management Options

Based on staff and stakeholder input, a range of habitat management options have been discussed in this process. A blend between the Option I (minimal) and Option II (moderate) approaches has emerged from this planning process as the recommendation and draft implementation strategies have been developed based on this. In short, the preferred management option favors preservation and enhancement of existing wetland and upland habitat where possible without major site disruption. In addition, some small-scale wetland restoration is proposed if funding becomes available.

Option I Minimal Approach	Option II Moderate Approach	Option III Maximum Approach
<ul style="list-style-type: none"> Maintain existing habitats and plant communities with some limited enhancements. Control the spread of invasive non-native species. 	<ul style="list-style-type: none"> Enhance existing habitats and restore wetland conditions in filled areas on a limited basis. Control spread of invasive non-native species. 	<ul style="list-style-type: none"> Fully restore wetland hydrology, habitat, and plant communities where they have been lost throughout the site. Aggressively work to eliminate all non-native vegetation from the site.

Proposed Management Actions

The following proposed actions reflect the preferred habitat management option shown above, the Management Goals, and staff and stakeholder input gathered during the planning process.

In general, the proposed actions are intended to maintain the area as an open space resource with a focus on wildlife habitat, passive recreation, and educational uses. In the short-term, minor enhancements to the native vegetation community are proposed, with an emphasis being placed on controlling invasive exotic species such as Scot's broom, reed canarygrass, and Himalayan blackberry and enhancing



Northern flicker

the native plant community in selected areas with the highest potential for success. Over the long term, additional enhancements to the site's vegetation may be attempted on a small-scale experimental basis as new techniques are developed and refined. Techniques that cause minimal site disruption should be utilized. In addition, approximately a half-acre of fill removal for wetland restoration is planned as funding becomes available. Formalized access to the site will be kept to a minimum to limit wildlife habitat disruption. At the same time, it is recognized that this site is also a public resource, and that access can not be restricted and that the site's habitat values will always be somewhat limited due to its highly urbanized surroundings.

Proposed Management Strategies

Goal 1: Wildlife Habitat

Enhance conditions for native wildlife species associated with wet prairie, forested wetland, and emergent wetland habitats



Habitat for Pacific tree frogs and other amphibians will be improved through restoration of the forest understory.

Strategies:

- Add structural diversity to the existing **forested wetland** areas by enhancing the native shrub understory to improve wildlife habitat conditions. Species to be added include snowberry (*Symphoricarpos albus*), Douglas' spirea (*Spirea douglasii*), nootka rose (*Rosa nutkana*), Douglas hawthorn (*Crataegus douglasii*), and Pacific ninebark (*Physocarpus capitatus*). In addition, slough sedge (*Carex obnupta*) and wooly sedge (*Carex lanuginosa*), two common ash forest understory species, should be introduced to this area to provide additional diversity. The understory will provide food, nesting area, perches, and cover for a variety of wildlife species.
- Introduce native prairie plant species to the site which could serve as nectar sources for **butterflies** and as host plants for butterfly larvae.
- Place **bird-nesting boxes** in trees throughout the site to accommodate species such as tree swallows, violet green-swallows, black-capped chickadees, and Bewick's wren. Bird boxes should be attached with strapping to avoid nailing directly into the tree.
- Retain all **existing trees** on site, but limit their spread into the prairie areas through mowing. Dead and dying trees should be left standing to provide perches and nesting cavities.

- Add **additional snags** to the site as has been done at the West Eugene Wetland Field Office. These are logs, which have been drilled and cut to provide nesting cavities for birds such as downy woodpecker and northern flicker, as well as bats. The logs are brought onto the site and set upright in a preferred location, much the way that a telephone pole would be positioned.
- Enhance the **riparian edge** along Amazon Creek by planting Oregon ash (*fraxinus latifolia*) and black cottonwood (*Populus trichocarpa*) on the top of the bank to provide habitat and shade the creek. Trees should be spaced to allow access by mowers, including access to the channel.
- To provide habitat for reptiles and amphibians, several small **rock piles** should be placed in dryer portions of the site. Reptiles such as common garter snake, northwest garter snake, and gopher snake use rock piles as shelter from predators and for basking because solar energy is stored in the thermal mass of rocks. Amphibians such as Pacific tree frogs, Northwestern salamander, and red-legged frog use rock piles in mostly shadier sites, where they offer cover and a moist microclimate. Small mammals also use rock piles for shelter and food storage. Large basalt chunks are ideal for this and piles should be a minimum of four feet in diameter and tall enough to be easily spotted by mowers.
- Minimize **mowing** on-site to reduce impacts to reptiles, amphibians, and invertebrates such as butterflies, blue mason bees, and other native insects that live in the tall grass. The site will be mowed once every year to keep the woody species from invading the prairie areas. Mowing after August 15 will help reduce wildlife loss.
- Concentrate **formalized access** and activity along the southern edge of the site to reduce disruption of wildlife elsewhere on the site.



Habitat snag



Rock piles will provide habitat for reptiles and amphibians.

Goal 2: Vegetation

Protect and enhance native wetland and upland plant communities throughout the site.



Native forbs such as camas (above) will be added to the southern wetland prairie area to enhance the native grass community that is already present.

- **Enhance the wet prairie** area along the southern edge of the site by introducing native forbs to improve species diversity to this area (see Action Plan Map). Currently, this is the highest quality wet prairie area currently on the site, but most of the native forb species are not present due to years of heavy mowing. Various techniques for re-introducing these species to this area should be attempted including planting seed (collected from other sites), plugs, and bare root plants from the Rachel Carson High School or other nursery, or planting salvaged plants from other sites. Species to be re-introduced include straightbeak buttercup (*Ranunculus orthorhynchus*), common camas (*Camassia quamash*), Hall's aster (*Aster hallii*), wild sunflower (*Wyethia angustifolia*), large-leaf lupine (*Lupinus polyphyllus*), fragrant popcornflower (*Plagiobothrys figuratus*), and gumweed (*Grindelia integrifolia*). Tufted hairgrass (*Deschampsia cespitosa*)

should be reintroduced where it is currently lacking.

- Over the long term, attempt to **enhance other wetland and upland prairie** areas through a variety of techniques. In these areas, low impact techniques such as solarization, tilling, and burning (possibly with an infrared burner) should be used to eradicate the existing non-native grass community. Following this, the area should be planted with a native seed mix, plugs, and bare root plantings (late fall). High impact techniques such as scraping should be avoided.
- Over the long term, **restore** approximately 0.65 acres of wetland along the western edge of the site by removing fill to reestablish wetland hydrology (see Action Plan). Fill material with an estimated depth of six to 18 inches is currently found in this area of historic wet prairie wetland. The fill material was likely graded into this area during past road construction and development activity. Based on general estimations of fill depth, approximately 1,250 cubic yards of material would be removed to bring the area back to its historic wetland grade. Pot-holing of this

area could help determine more accurately the depth of fill.

The technique to be used for restoration will involve excavating and removing the fill material, using the native hydric soil as the guide for setting the grade. This same technique was successfully used on the Eastern Gateway mitigation site in 1994 and other west Eugene sites in subsequent years.

The break between the native soil and imported fill is typically very apparent. In addition to the prairie restoration, a deeper vernal pool will be created within the restoration area to diversify the wetland habitat and to serve as an easily accessible dip-netting area for visiting students.

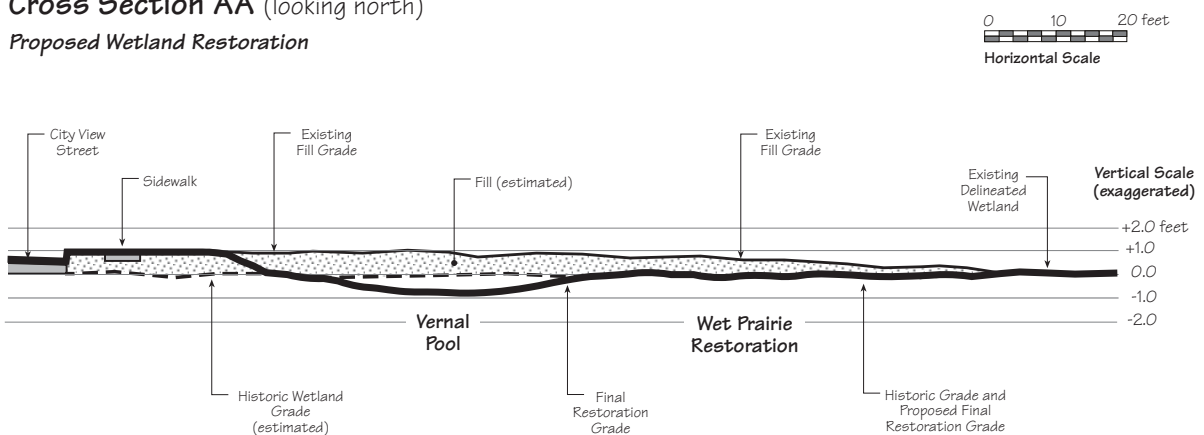
In areas where fill is being removed immediately adjacent to the existing wetland, the final grade should approximate the adjacent wetland grade to assure proper hydrologic conditions and to avoid impacting the existing wetland's hydrology (see Cross Section AA). City staff will closely monitor excavation to ensure the proper final grade is achieved. Upon completion of fill removal, the



The proposed fill removal and wetland restoration area would resemble the Eastern Gateway site shown above, which was restored in 1994.

Cross Section AA (looking north)

Proposed Wetland Restoration



Note: This cross section is for illustrative purposes and does not represent surveyed topographic information for either the existing or historic grades. Fill should be removed to the level of the historic hydric soil layer in the restoration area with the exception of the vernal pool, which will be approximately one six to twelve inches deeper than the historic grade.



The native shrub understory, such as the nootka rose (above), will be re-introduced in the forested wetland area to improve wildlife habitat conditions.



Reed canarygrass and other invasive exotics should be controlled to prevent their spread to the rest of the site.

site will be fine graded and planted with a mix of native wet prairie and emergent species (see Proposed Planting List), most likely in late September. City staff will do the planting, using a backpack seed blower, and will vary the seed mix based on the final grade and estimated hydrologic conditions. The seeding can be supplemented by plantings of plugs, bulbs, and salvaged plants from other sites, all of which can be done by volunteers or Youth Corps workers.

- In the existing **forested wetland** areas, add species diversity by introducing a native understory including snowberry (*Symphoricarpos albus*), Douglas' spiraea (*Spirea douglasii*), nootka rose (*Rosa nutkana*), Douglas hawthorn (*Crataegus douglasii*), Pacific ninebark (*physocarpus capitatus*), slough sedge (*Carex obnupta*), and wooly sedge (*Carex lanuginosa*) as indicated under Goal One.
- **Retain all existing trees** on site, but control their spread through mowing. Although not native, the three large weeping willow (*Salix babylonica*) should be retained for their visual and habitat value.
- Control **invasive exotic species** throughout the site such as reed canarygrass (*Phalaris arundinacea*), Harding grass (*Phalaris aquatica*) Himalayan blackberry (*Rubus armeniacus*), evergreen blackberry (*rubus laciniatus*), teasel (*Dipsacus fullonum*), and Scot's broom (*Cytisus scoparius*) through mowing, hand weeding, herbicide application (where no other technique is effective), and other techniques to prevent their spread.
- Fill or block the two **shallow trenches** that were illegally cut to drain the ponded areas.
- **Mow** upland and wetland prairie areas once annually between mid-August and late-September to replicate the burning cycle that was once common in the valley and to keep the prairie areas from converting to forest. Burning is not a feasible option for the site due to its highly urban setting.

Goal 3: Recreation

Limit on-site recreation to passive uses such as nature study, bird watching, and walking.

Strategy:

- Maintain the site in a *natural* and undeveloped condition.

Goal 4: Education

Provide an educational resource or outdoor classroom for area schools and neighbors.

Strategies:

- **Enhance** native plant and wildlife communities to improve the site's educational and interpretive value.
- Develop a **fact sheet** about the site that includes information on its history, wildlife, and plant communities for use by area schools and interested citizens. This will also help promote understanding and stewardship of the site.
- Provide **access** to the ponded areas for dip-netting via the mowed trail from City View Street. Following wetland restoration in the area adjacent to City View Street, dip-netting and other nature study can be accommodated in this area.
- Install an **informational/interpretive sign** at the trailhead. The sign's purpose will be to provide some limited interpretive information about the site (wetlands, plants, and wildlife) and emphasize City regulations such as leash law and the no camping ordinance. The sign would also ask visitors to limit their impact to the site.



With its proximity to area schools, the Gudu-kut Natural Area has great potential to become an educational resource. Access will be controlled to limit impacts to plants and wildlife. The photo is taken at the Eastern Gateway restored wetland.

Goal 5: Access

Provide access to the site for passive recreation and educational uses, but limit the extent of a formalized trail system.

Strategies:

- To provide access into a site for passive recreation and educational purposes, a **trail** should be provided from the sidewalk along City View Street near the southern edge of the site (see Action Plan Map). This trail will not be surfaced but will be demarcated by a mowed strip approximately six feet in width. The purpose of the trail



A mowed trail will help direct access onto the southern edge of the site.

will be improve accessibility onto the site when the tall grass makes walking difficult and to direct access away from more sensitive areas. Over the long term, the City will monitor the trail's usage and re-evaluate its location and surfacing. The need for this trail may be eliminated after the wetland restoration occurs in the area adjacent to City View Street, providing a more accessible area for students to study wetlands.

Goal 6: Safety

Provide a safe and secure environment for students and neighbors using the site and discourage illegal activities on the site such as camping.

A visual line of site should be maintained between the adjacent apartments and the forested wetland areas on the eastern side of the site to help deter illegal activities.

Strategies:

- Maintain a mowed **firebreak** along the northern and southern edges of the site to protect the Leawood Townhomes and West Hills Village Apartments.
- To help deter **camping** on the site, keep the forested areas visually accessible by pruning the existing trees to a height of eight feet and keeping the area free of blackberry thickets. Visibility should be considered as the native understory species are reintroduced to the forested areas.
- Maintain the visual **line of site** from the windows of the northern West Village Apartment building and the site (see Action Plan Map). The perception of visual surveillance, whether real or imagined, will help deter campers and other illegal activities.
- The adoption group and neighbors should help monitor the site on a regular basis and **illegal activities** should be reported to the City of Eugene at 682-4800.



Goal 7: Maintenance

Minimize site maintenance requirements and work with volunteers to help care for site over time.

Strategies:

- **Mowing** will continue to be an important management technique for the site. The following mowing zones have been established for the site:
 - **Prairie Zone:** In order to retain prairie/savanna character and prevent colonization by woody species, the upland and wetland prairie areas should be mowed once annually, ideally between mid-August and late-September. This timing will allow plants to go to seed and birds to finish nesting. As for reptiles, amphibians, and insects, the delayed mowing regime will give them more time to reproduce and find adequate food and shelter. The City will reevaluate the mowing regime to determine if less frequent mowing is possible over time. Burning is not a feasible option for the site due to its highly urban setting. More frequent mowing or weed wacking to control reed canarygrass and Harding grass may occur in this zone.
 - **Perimeter Fire Protection Zone:** The City is required to maintain a firebreak on the edges of the site that border private structures. Mowing in these areas will occur two to three times per year depending on conditions with the first mowing occurring prior to June 15. The mow zone will be approximately 40 feet wide along the northern edge of the site adjacent to the Leawood Townhomes where the site is in very close proximity to the structures and where trees are present that could serve as fire ladders. A 25-foot buffer will be required along the southern edge of the site because the structures are set further back and an irrigated lawn exists between the apartments and the site (see Action Plan Map).
 - **Forested Zone:** In order to allow the woody understory layer to be reintroduced to these areas, mowing with large machinery will not be possible. Instead, motorized brush cutters and hand tools will be used in these areas as needed to control exotic species such as blackberry, teasel, reed canarygrass, and Scot's broom where it occurs. This is a task well suited for volunteers as well.



Perimeter fire protection zones must be maintained along the site's northern and southern edges.



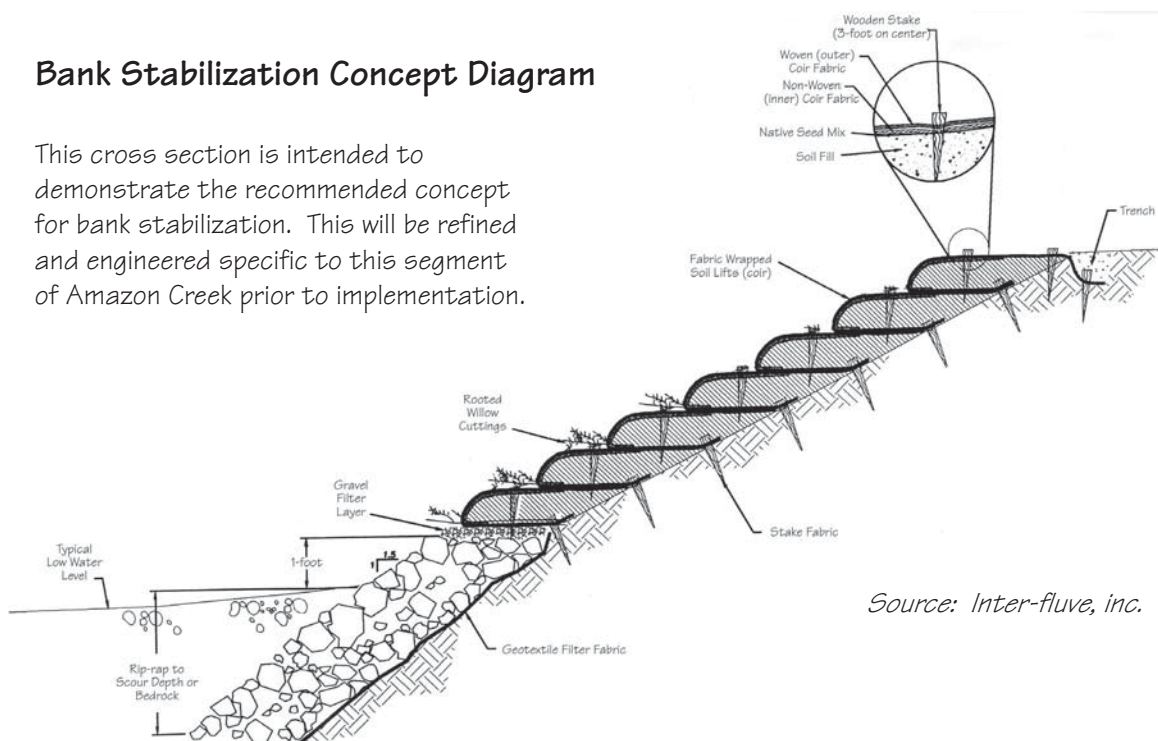
Slumping bank of
Amazon Creek

- Establish a **volunteer adoption group** for the site through the City's *Stream Team* program. Volunteer activities could include planting, vegetation management, litter collection, and monitoring.
- Where additional **trees** are planted on the site (southern edge and along Amazon Creek), provide ample spacing to allow mowers easy access.
- **Stabilize the bank** of Amazon Creek along the eastern edge of the site to eliminate the current slumping and erosion problems. It has been determined that significant channel widening is not feasible in this area due to the limited length of channel in this section and the close proximity of existing delineated wetlands on the City View site. Instead, a bioengineering technique, that will require only limited modification to the existing slope should be used.

The recommended stabilization technique will involve placing rip-rap along the toe of the slope to a level below the channel scour depth up to approximately one-foot above the typical low water line. Above that, layers of fabric wrapped soil lifts (coir), filled with top soil and native seed mix will be staked into place until they reach the top of bank (see detail). Rooted willow cuttings should be placed between the lower soil lifts to provide enhanced stabilization and additional habitat.

Bank Stabilization Concept Diagram

This cross section is intended to demonstrate the recommended concept for bank stabilization. This will be refined and engineered specific to this segment of Amazon Creek prior to implementation.



Source: Inter-fluve, inc.

Goal 8: Visual Quality

Enhance the visual quality of the site and reduce the visual impact of adjacent development on views from the site.

Strategies:

- Plant several bigleaf maple (*Acer macrophyllum*) in a *naturalistic cluster* along the southern edge of the site to help soften and **screen views** from the site to the adjacent apartments and parking lot. Trees should be planted to allow enough spacing to accommodate a mower.
- Introduce **showy flowering native plant species** to the wet prairie enhancement area (see vegetation goal for species). In addition, introduce highly visible flowering plant species to the upland and wetland areas adjacent to the creek to create a visual amenity for people using the bike path. Species such as large-leaf lupine (*Lupinus polyphyllus*), Camas (*Camassia quamash* and *leichtlinii*), woolly sunflower (*Eriophyllum lanatum*), and wild sunflower (*Wyethia angustifolia*) would be appropriate for this purpose.



Existing view from the eastern half of the site (looking north). Over time, a cluster of bigleaf maple will be planted along this edge to help screen the view.



Large-leaf lupine (*Lupinus polyphyllus*)



Wild sunflower
(*Wyethia angustifolia*)

Tasks List

Task	Ongoing	Short-Term*	Long-Term**	Notes
Enhance forested wetland understory		C,V		late fall to early spring
Enhance prairie forb layer on southern edge of site		C,V		late fall to early spring
Enhance upland and wetland prairie throughout the site using various techniques to eliminate exotic vegetation.			C,B,V	Will occur a small scale in experimental plots.
Restore wetland adjacent to City View Street			C,B,V	Late summer-fall; significant cost.
Place bird boxes		V		Prior to nesting season (early spring)
Remove exotic vegetation	C	V		Major work should be scheduled to avoid nesting season (April 1 to July 15); reed canarygrass and Harding grass control should be given top priority.
Add snags		C,B		
Place rock piles		C,V		
Mow	C			See mowing schedule
Mow trail route	C			Mow while mowing fire breaks
Fill drainage trenches		C,V		
Install sign		C	C,B	Design interpretive sign with BLM assistance.
Develop fact sheet			C,V	
Monitor the site for illegal activity	C,V			
Plant bigleaf maple buffer			C,V	Contingent on approved EA
Plant riparian buffer			C,V	Contingent on approved EA
Stabilize bank of Amazon Creek			C	Additional engineering required; significant cost.
Relocate private sewer line		C		

Responsibilities Key:

C=City of Eugene

B=Bureau of Land Management

V=Volunteers

*Short-term indicates a task that can be done as soon as resources are available.

**Long-term indicates a task that is lower priority or that may require significant financial resources.

Proposed Planting List

Wet Prairie Wetland Restoration Mix*

Wet prairie species listed below are to be planted in the area adjacent to City View Street that is proposed for restoration.

Scientific Name	Common Name	Indicator Status
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Dominant species; approximately 60% to 70% of the seedling will be with the following:

Graminoids	<i>Agrostis exarata</i>	spike bentgrass	FACW
	<i>Carex unilateralis</i>	one-sided sedge	FACW
	<i>Deschampsia cespitosa</i>	tufted hairgrass	FACW
	<i>Juncus nevadensis</i>	Sierra rush	FACW
	<i>Juncus tenuis</i>	slender rush	FAC
Forbs	<i>Aster hallii</i>	Hall's aster	FAC
	<i>Camassia quamash</i>	common camas	FACW
	<i>Gratiola ebracteata</i>	bractless hedge-hyssop	
	<i>Microseris laciniata</i>	cut-leaf microseris	NOL
	<i>Potentilla gracilis</i>	slender cinquefoil	FAC
	<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>	self-heal	CU
	<i>Ranunculus orthorhynchus</i>	straightbeak buttercup	FACW-

Smaller amounts of the following will be seeded as available:

Graminoids	<i>Beckmannia syzigachne</i>	American slough grass	OBL
	<i>Carex lanuginosa</i>	woolly sedge	OBL
	<i>Danthonia californica</i>	California oat-grass	FACU-
	<i>Eriophyllum lanatum</i>	wooly sunflower	NOL
	<i>Luzula campestris</i> var. <i>multiflora</i>	field woodrush	FACU
	<i>Panicum occidentale</i>	western panic-grass	FACW
Forbs	<i>Boisduvalia densiflora</i>	dense spike-primrose	FACW-
	<i>Grindelia integrifolia</i>	gumweed	FACW
	<i>Lomatium nudicaule</i>	barestem lomatium	NOL
	<i>Lotus formosissimus</i>	seaside trefoil	FACW+
	<i>Lotus purshianus</i>	Spanish-clover	NOL
	<i>Montia linearis</i>	narrow-leafed montia	NOL
	<i>Orthocarpus bracteatus</i>	rosy owl-clover	NOL
	<i>Perideridia gairdneri</i>	Gairdner's yampah	FACU
	<i>Ranunculus occidentalis</i>	western buttercup	FACW
	<i>Saxifraga oregana</i>	Oregon saxifrage	FACW+
	<i>Sidalcea cusickii</i>	Cusick's checkermallow	NOL
	<i>Sisyrinchium idahoense</i>	blue-eyed grass	FACW
	<i>Wyethia angustifolia</i>	narrow-leaf muleears	FACU
	<i>Zigadenus venenosus</i>	death camas	FAC

* The proposed planting list is intended for use in the proposed wetland restoration area (adjacent to City View Street) and will likely be reassessed and fine tuned by BLM and TNC botanists to fit actual site conditions and seed availability. Much of the seed is hand collected in the vicinity and availability can vary greatly from year to year.

Emergent Wetland Mix**

Emergent species listed below will be planted in and around the proposed vernal pool area.

	Scientific Name	Common Name	Indicator Status
Dominant species; approximately 60% to 70% of the seedling will be with the following:			
Graminoids	<i>Beckmannia syzigachne</i>	slough grass	OBL
	<i>Hordeum brachyantherum</i>	meadow barley	FACW
	<i>Carex densa</i>	dense sedge	OBL
	<i>Carex ovalis (leporina)</i>	hare sedge	FACW
	<i>Carex unilateralis</i>	one-side sedges	FACW
Forbs	<i>Downingia elegans</i>	common downingia	OBL
	<i>Eryngium petiolatum</i>	coyote thistle	OBL
	<i>Plagiobothrys figuratus</i>	fragrant popcorn-flower	FACW

Smaller amounts of the following will be seeded as available:

Graminoids	<i>Aristida oligantha</i>	prairie threeawn	NOL
	<i>Deschampsia danthonioides</i>	annual hairgrass	FACW-
	<i>Glyceria occidentalis</i>	northwestern mannagrass	OBL
	<i>Juncus nevadensis</i>	Sierra rush	FACW
	<i>Juncus oxymeris</i>	pointed rush	FACW+
Forbs	<i>Gratiola ebracteata</i>	bractless hedge-hyssop	OBL
	<i>Lasthenia glaberrima</i>	smooth lasthenia	OBL
	<i>Rumex salicifolius</i>	willow dock	FACW
	<i>Veronica scutellata</i>	marsh speedwell	OBL

****** The proposed planting list is intended for use in the proposed wetland restoration area (adjacent to City View Street) and will likely be reassessed and fine tuned by BLM and TNC botanists to fit actual site conditions and seed availability. Much of the seed is hand collected in the vicinity and availability can vary greatly from year to year.

Forested Wetland Enhancement***

To be planted within the designated ash forest wetlands.

	Scientific Name	Common Name	Indicator Status
Graminoids	<i>Carex lanuginosa</i>	Wooly sedge	OBL
	<i>Carex obnupta</i>	Slough sedge	OBL
Shrubs	<i>Crataegus douglasii</i>	Douglas hawthorn	FAC
	<i>Physocarpus capitatus</i>	Pacific ninebark	FACW
	<i>Rosa nutkana</i>	Nootka rose	FAC
	<i>Spiraea Douglasii</i>	Douglas' spirea	FACW
	<i>Symphoricarpos albus</i>	Snowberry	FACU

*** The proposed planting list is intended for use in the forested wetland area (indicated on Action Plan Map) and will likely be reassessed and fine tuned based on City volunteer coordinator recommendations and plant availability. The shrub species will likely be planted as bare root stock and the sedges will be planted as plugs or transplants from salvage.

Wet Prairie Enhancement

To be planted with in wetland prairie area along the southern edge of the site.

	Scientific Name	Common Name	Indicator Status
Graminoids	<i>Deschampsia cespitosa</i>	Tufted hairgrass	FACW
Forbs	<i>Aster hallii</i>	Hall's aster	FAC/FACW
	<i>Camassia quamash</i>	Common camas	FACW
	<i>Grindelia integrifolia</i>	Gumweed	FACW
	<i>Lupinus polyphyllus</i>	Large-leaf lupine	FAC+
	<i>Plagiobothrys figuratus</i>	Fragrant popcornflower	FACW
	<i>Ranunculus orthorhynchus</i>	Straightbeak buttercup	FACW-
	<i>Wyethia angustifolia</i>	Wild sunflower	FACU

Appendix A

Delineation Report

The wetland delineation for the site was conducted by Judith Henschel in July 1996. Only the background, site report, conclusions, and delineation map from the report are included in this appendix. The remainder of the report is on file with the City, the Division of State Lands, and Lane Council of Governments.

Appendix B

Bird Box Plans and Information

Appendix C

General Landscape History of West Eugene

General Landscape History of West Eugene

This section provides general information on how the landscape of west Eugene formed and has been transformed over time. This information provides the context needed to develop an informed MIP.

Geology, Geomorphology, and Soils

The Eugene-Springfield area is in the southern Willamette Valley, where the Coast Range and the Cascade Range meet. The valley is flat-bottomed, with isolated buttes and maturely dissected hills on its southern and eastern margins. The wetlands in west Eugene are on the Calapooyia geomorphic surface, which formed from sediments on the main valley floor. For purposes of discussing wetland mitigation, the important points about soils and geomorphology in west Eugene are the heavy clay soils, perched water table, and microtopography. Characteristics of the Calapooyia surface and of the sediment deposits explain the concentration of hydric soils in west Eugene.

The Calapooyia surface formed about 10,000 years ago, during the last part of the ice age, when huge volumes of water flooded the Columbia River after glacier-dammed lakes in Montana broke. Floodwaters backed up into the Willamette Valley and fine sediments (clays and silts) settled out, forming the Calapooyia surface. Soils on the Calapooyia that occur in west Eugene have heavy clay subsoil horizons with silty surface horizons. A perched water table sits on top of the heavy clay layer, saturating the soil and ponding water on the surface as deep as a foot and a half.

The clay layer has high shrink/swell properties. Areas where clay is near the surface exhibit a hummocky microtopography—slightly higher circular or oval mounded areas interspersed with lower, poorly drained braided areas. The mounded areas have a relief of approximately two feet. (Lane Council of Governments, February 1993, *Mitigation Options for Eight Sites in West Eugene*, pp. 15-29)

Hydrology

The Calapooyia surface in Lane County is at an elevation of 320 to 400 feet and the topography has little relief, causing a poorly defined drainage pattern and slow drainage of surface water. Waterways, such as Amazon Creek, did not have a well-defined channel and migrated over much of the valley floor. Much of the surface water within these wetland areas moved through shallow swales or occurred as sheet flow, slowly moving in a northwesterly direction.

Amazon Creek is a vastly different waterway today than it was near the turn of the century. To enhance the creek's flood capacity, the Army Corps of Engineers and the Soil Conservation Service has deepened, widened, or lined all but the upper reaches of the creek and its tributaries since the late 1940s. This has largely disconnected the hydrology of the creek with the adjacent wetlands.

Vegetation

The three major plant communities present in the west Eugene area before settlement included wet prairie, upland prairie, and upland Savannah. (See Historic Vegetation Map.)

Of these plant communities, wet prairie grasslands were the most abundant type in west Eugene, occurring over large areas on alluvial terraces. At the time of settlement, this wetland type was abundant and widespread in the Willamette Valley, occupying some 350,000 acres. Agricultural practices, livestock grazing, and urban development have dramatically reduced the extent of this plant community over the last 150 years, and now only about one percent of the Willamette Valley's original prairie grasslands still survive. For these reasons, wet prairie grassland is one of the most important wetland types from a habitat conservation standpoint in west Eugene and the Willamette Valley. (The Nature Conservancy, February 1993, *Assessment of Proposed Wetland Mitigation Areas in West Eugene*, p.10).

Cultural History of West Eugene

Pre-settlement use by the Kalapuya Indians followed by agricultural and urban uses create layers of cultural history in west Eugene. Until the mid-1800s, the Kalapuya Indians burned much of the Willamette Valley annually. The fires helped to maintain the open prairie habitats that support wild food plants such as camas lily and tarweed. The Kalapuyas selected areas of slightly higher, drier ground close to the large expanses of Natroy and Dayton soils in west Eugene as camas processing sites. Here they built ovens to bake the camas. The flat wet terraces of the west Eugene area made it a major camas production area for the Kalapuyas—the breadbasket for the lower Willamette Valley. (Johannessen, 1971, *The Vegetation of the Willamette Valley, Annals of the Association of American Geography*, vol. 61, n. 2; Makinson, personal communication, cultural site correlation with geomorphic surfaces, May, 1998; Oetting, September 29, 1995, *Archaeological Investigations for the Amazon Creek Wetlands Restoration Project, Lane County, Oregon*).

In the late nineteenth century, settlers began putting land in west Eugene into agricultural production, altering natural drainage patterns and replacing native vegetation with crops. Farmers re-routed drainages to make it easier to work around them with equipment. They deepened natural channels and typically dug shallow trenches or furrows at 50-foot intervals to improve surface drainage. The trenches did not lower the perched water table in the slowly permeable clay soils, but were effective at draining surface water to allow uses like grazing, and growing wheat and barley. Annual ryegrass, which does not require drainage, replaced these as the most profitable crop to grow on these wet soils in the 1950s. Agricultural practices generally have flattened out most of the local Calapooyia microtopography that once existed in west Eugene.

The west Eugene area was mostly agricultural through the mid-twentieth century. As the City of Eugene expanded and became more urban, flood control channels were constructed to drain stormwater away from city streets. The City of Eugene zoned west Eugene for industrial use in the late 1950s. A mixture of heavy and light industries developed in a scattered pattern through the late 1980s, when large areas of wetlands were discovered. Other alterations for urban use include clearing and filling for buildings and streets, storm drainage and re-routing of natural drainages, and excavation to build log ponds and as borrow areas for fill.

Alteration of drainage, introduction of non-native vegetation, heavy grazing, the cessation of burning, and urban development all have contributed to the loss of native wet prairies. Woody and exotic species have colonized much of the west Eugene area as agricultural practices have declined in recent decades. Birds, water, and wind spread seeds of introduced species into noncultivated sites.

